THE NATURALIST.

MAY, 1832.

THE OLIVE TREE.

Olea europæa.

This ornament of the vegetable kingdom, which is called by Columella, the first among trees, has constituted from the remotest antiquity, the pride of some of the most celebrated regions of the globe; and, aside from the commercial value of its products, it is invested, both by sacred and profane history, with a thousand interesting associations.

Of this tree we have very ancient mention, since it is related in the book of Genesis, that the dove which Noah sent out of the ark, returned with an olive leaf in its mouth, by which he knew that the waters of the deluge had abated. Since that time the olive branch has been used as an emblem of peace by all civilized nations; and it is observed that a green bough answers the same purpose among the most savage people in every part of the globe.

That the olive tree was anciently very much esteemed by the Hebrews, is proved by the parable of Jotham:—'*The trees went forth on a time to anoint a king over them; and they said to the olive tree, reign thou over us. But the olive tree said unto them, should I leave my fatness, wherewith by the honor of God and man, and go to be promoted over other trees?*' David also seems to have considered the olive as a blessing, when he says '*Thy children, like the olive branches round about thy table: Lo! thus shall the man be blessed that feareth the Lord.*'

The Grecians appear to have thought no less of this tree and of its fruit, than the Israelites. In their fabulous histories, we are informed that the gods having been called on to settle a dispute

between Neptune and Minerva, arising from the desire of each of them to give a name to the new city of Cecrops; they determined to give the preference to the one who should produce the most beneficial gift to mankind. Neptune, striking the ground with his trident, created a horse; but Minerva, by causing an olive tree to spring from the earth, gained her point, and from her was the city called Athenæ, now Athens; since, the olive, the emblem of peace or agriculture, was much preferred to the horse, the symbol of war and bloodshed. Minerva and the Graces are also represented as crowned with olive branches.

A contribution of olives was given by all the Grecians who attended the *Panathenæa*, a festival held at Athens in honor of Minerva. Those who excelled in any of the games during this festival, were crowned with a wreath of olives, which grew in the grove of Academus, a place near the city, with spacious and shady walks, belonging to a man of that name. Plato having here opened a school of philosophy, all places of learning have been since called *Academies*.

As to the native country of the olive, we may conclude, from several passages in scripture, that it grew naturally in Syria; but particularly near Jerusalem, if we may judge by the 'Mount of Olives,' so often mentioned in the New Testament. It was first planted in Italy, in the thirteenth year of the reign of Servius Tullis, the sixth king of Rome; and in that very year was Nebuchadnezzar restored to his understanding and his kingdom, after having spent seven years among the beasts of the field.

The olive seems to have been highly appreciated by the Romans; as Pliny says, 'except the vine, there is not a tree bearing fruit of so great account as the olive.' Fenestella informs us, continues this author, 'that during the reign of Tarquenius Priscus, which was about the 183d year from the foundation of Rome, there were no olive trees, either in Italy, Spain, or Africa, which is a strong presumption that they grew originally only in Syria.' Theophrastus states that in the 440th year of the city, there were no olive trees in Italy, but on the coast, and within forty miles of the sea; but Pliny says, in his time, they were to be found in the very heart of Spain and France, but that the olives of Syria, although smaller, produces the best oil. Virgil mentions but three kinds of olives. Columella mentions ten varieties, but says, he believes they were much more numerous.

In the olive yards of France, the olive tree generally attains the height of eighteen or twenty five, with a diameter of six inches to two feet. It ramifies at a small height, and forms a compact rounded summit. The foliage is of a pale, impoverished verdure,

and the general appearance of the tree is not unlike that of a common willow which has been lopped, and which has acquired a new summit of three or four years, growth. Indeed the olive possesses neither the majesty of forest trees, nor the gracefulness of shrubbery. It clothes the hills, without adorning them, and, con sidered as an accident of the landscape, it does not charge the picture sufficiently to contribute greatly to its beauty. The rich culture for which the southern provinces of France are celebrated, is less conducive to rural beauty than some of the humbler species of husbandry. The richest country is not always the most lovely; a country of mines, for example, is usually ungracious to the eye; and the olive is called by an Italian writer, a mine upon the surface of the earth.

The main limbs of the olive are numerously divided; the branches are opposite, and the pairs are alternately placed upon conjugate axes of the limb. The foliage is evergreen, but a part of it turns yellow and falls in the summer, and in three years it is completely renewed. In the spring or early autumn, the seasons when vegetation is in its greatest activity, the young leaves put forth immediately above the cicatrix of the former leaf stalks, and are distinguished by their suppleness, and by the freshness of their tint. The color of their leaves varies in the different varieties of the olive, but they are generally smooth, and of a light green above, whitish and somewhat downy, with a prominent rib beneath. On most of the cultivated varieties they are from fifteen lines to two inches long, and from six to twelve lines broad, narrow, with both ends acute, even and whole at the edge, placed immediately on the main stem without a foot stalk, opposite and alternate in the manner of the branches.

The olive is slow in blooming, as well as in every function of vegetable life. The buds begin to appear about the middle of April, and the bloom is not full before the end of May, or the beginning of June. The flowers are small, white, slightly odoriferous, and disposed in axillary *racemes* or clusters. A peduncle about as long as the leaf, issues from its base, upon which the flowers are supported by secondary pedicles, like those of the common currant. Sometimes the clusters are almost as numerous as the leaves, and garnish the tree with wanton luxuriance; at others they are thinly scattered over the branches, or seen only at the extremity. It is essential to remark, that they are borne by the shoots of the preceding year. Each flower is complete in itself, consisting of a calyx, a monopetalous corolla divided into four lobes, and in the organs of reproduction, namely, two stamens and one pistil.

A week after the expanding of the flower, the corolla fades and falls. If the calyx remains behind, a favorable presage is formed of the fruitfulness of the season: but the hopes of the husbandman are liable to be blasted at this period, at the slightest intemperateness of the elements, which causes the germ to fall with the flower. Warm weather, accompanied by gentle breezes that agitate the tree and facilitate the fecundation, is the most propitious to his wishes.

The fruit of the olive is called by botanists, a *drupe*. It is composed of pulpy matter enveloping a stone, or ligneous shell, containing a kernel. The olive is egg-shaped, pointed at the extremity, from six to ten lines in diameter, in one direction, and from ten to fifteen lines in the other; on the wild tree, it hardly exceeds the size of the red currant. The skin is smooth, and, when ripe, of a violet color; but in certain varieties, it is yellowish or red. The pulp is greenish, and the stone is oblong, pointed and divided into two cells, one of which is usually void. The oil of the olive is furnished by the pulp, which is a characteristic almost peculiar to this fruit; in other oleaginous vegetables, it is extracted from the seed. The young olives set in June, increase in size, and remain green through the summer, begin to change color early in October, and is ripe at the end of November, or in the beginning of December. On the wild olive, five or six drupes are ripened upon each peduncle; but on the cultivated tree a great part of the flowers are abortive, and the green fruit is cast at every stage of its growth, so that rarely more than one or two germs upon a cluster arrive at maturity.

On the branches of the olive, and on the trunk of the young, tree the bark is smooth, and of an ashy hue. When the epidermis is removed, the cellular integument appears of a light green. On old trees, the bark upon the trunk, and upon the base of the principal limbs is brown, rough and deeply furrowed. In the spring and autumn, when the sap is in motion, the bark is easily detached from the body of the tree. The wood is heavy, compact, fine-grained and brilliant. The alburnum is white and soft, and the perfect wood is hard, brittle and of a reddish tint, with the pith nearly effaced as in the box wood. It is employed by cabinet makers to inlay the finer species of wood which are contrasted with it in color, and to form light ornamental articles, such as dressing cases, small boxes, &c. The wood of the roots, which is more agreeably marbled, is preferred. The olive was classed by the ancients, among the hard and durable species of wood, such as the ebony, the cedar, the box, the lotus. On account of its hardness, it was used for the hinges of doors, and before metal

became common in statuary, it was selected by the Greeks for the images of their gods. Three statues of Minerva were preserved in the citadei of Athens, which exemplified the progress of this admirable art; the first, made of olive wood, and of rude workmanship, was said to have fallen from heaven; the second, of bronze, was consecrated after the victory of Marathon; the third, of gold and ivory, was one of the miracles of the age of Pericles. From its resinous and oleaginous nature, the olive wood is eminently combustible, and burns as well before, as after it is dried. The value of its fruit renders this property unimportant. This tree may be multiplied by all the modes that are in use for the propagation of trees and requires but little care in the cultivation, and produces fruit once in two years. This fruit, the modern Greeks, during Lent, eat in its ripe state, without any preparation, but a little pepper, or salt and oil.

We receive it from the south of France, from Spain and Portugal, pickled in the following manner. It is gathered unripe, and suffered to steep in water some days, and is afterwards put into a lie of water and barilla, or kali, with the ashes of olive stones, or with lime. It is then bottled or barrelled with salt and water, and in this state do we meet with it at the deserts of our most wealthy tables, where fashion has done much in having introduced and given a fondness for olives, which seems to be an acquired taste; however, they are grateful to the stomach and are considered good to promote digestion and appetite.

But olives are chiefly cultivated for the sake of the oil that they produce, which is not a profitable article of commerce, but forms a principal one of food to the inhabitants of the places where these trees are found. This oil is contained in the pulp only, as before observed, whereas other fruits have it in the nut or kernel. It is obtained by simple pressure, in the following manner. The olives are first bruised by a millstone, and afterwards put into a sack, and then into the trough of a press, for the purpose, which, by means of turning a strong screw, forces all the strong liquor out, which is called *virgin oil.* It is received in vessels half filled with water, from which it is taken off, and set apart in earthen jars. Several coarser kinds are obtained afterwards, by adding hot water to the bruised fruit.

The oil of olive seems to have been of great utility to the ancients, since Aristæus, son of Apollo, by Cyrene, was regarded as a rural deity, for having taught mankind to extract it, and also to make honey, cheese and butter. The wrestlers were anointed with it; and it was made a substitute for butter, which among the Romans was used as a medicine.

We find in the book of Leviticus, that oil formed a principal part of the meat offerings, which the Israelites presented to the Lord, '*If thou bring a meat offering baken in the oven, it shall be unleavened cakes of fine flour, mingled with oil, or unleavened wafers, anointed with oil. And if thy oblation be a meat offering, baken in the fryingpan, it shall be made of fine flour with oil.*'

Pliny informs us, that in the 500th year of the city, when Appius Claudius and L. Junius were consuls together, a pound of oil was sold for twelve asses; but that in the year 680, ten pounds of oil sold for one ass, and that in twenty-two years after that time, Italy was able to furnish the provinces with oil; and it was much used at their baths, having, as they supposed, the property of warming the body and defending it against the cold.

The best olive oil, at present, is obtained from Provence. It is esteemed good for the breast and lungs; it tempers the sharp choleric humors in the bowels, and is useful against all corrosive mineral poisons, as arsenic, lead, *&c.*

Thus have we rapidly sketched an outline of the history and uses of the far-famed olive. Among the gifts of Minerva which adorn our rising republic, policy, arts and arms, may we hope to see her favorite tree enrich our soil. Some light may be thrown upon this inquiry, by an examination of our climate, but it can be resolved only by experience.

The eastern and western shores of the Atlantic Ocean differ essentially in the phenomena of climate. In Europe, the distribution of heat through the seasons, is more uniform, and the medium of the year more elevated. This equability is highly favorable to the perfection of vegetation; hence that of America is meliorated in the corresponding one in Europe, while many productions of that country cannot exist under the same parallels in America. We are obliged, also, to migrate in the train of the seasons in quest of an agreeable temperature, which the most favored Europeans enjoy without changing their native signs. We experience, in the same latitude, the summer of Rome, the winter of Copenhagen, and the mean temperature of the coast of Britain. Nor is this difference attributable to the state of cultivation, nor to any accidental cause with which we are acquainted. In the eternal forests which shroud our north-western coast, we find again the delicious climate of Europe, while Tartary and China repeat the phenomena of our own. For the enjoyment of life, and for the richness of agriculture, we should have been more advantageously situated on the opposite side of the continent.

The olive requires a climate whose mean temperature is equal to 57° 17′, and that of the coldest month to 41° 5′. In the Uni-

ted States, where the mean temperature of the year is 57° 17′, that of the coldest month is only 0° 5′, with some days far more intense. The capriciousness of our climate is still more dangerous to delicate vegetables, than its inclemency; the difference of temperature in a single day is almost equal to that of the whole year in the south of Italy. The olives near Charleston, South Carolina, are rendered barren by the vernal frosts which congeal the young shoots. In a more southern latitude they would be secure in the winter, but they would languish through a sultry summer, unrefreshed by the healthful breezes which they respire on the shores of the Mediterranean Sea; they would, besides, find a silicious, instead of a calcareous soil.

Notwithstanding these obstacles, tracts, uniting the conditions necessary for the growth of the olive, may probably be found sufficiently for our own wants. The possibility of its flourishing on our shores, has been demonstrated by several experiments; one in particular which we shall relate. While the Floridas were held by the English, an adventurer of that nation led a colony of Greeks into the eastern province, and founded the settlement of New Smyrna: the principal treasure which they brought from their native clime, was the olive. Bartram, who visited this settlement in 1775, describes it as a flourishing town. Its prosperity, however, was of momentary duration; driven to despair by hardship and oppression, and precluded from escape by land, where they were intercepted by the wandering savages; a part of these unhappy exiles conceived the hardy enterprize of flying to the Havanna in an open boat; the rest moved to St. Augustine, when the Spaniards resumed possession of the country. In 1783, a few decaying huts and several large olives, were the only remaining traces of their industry.

Louisiana, the Floridas, the islands of Georgia, and chosen exposures in the interior of the state, will be the scene of this culture. Perhaps it will be extended to some parts of the Western States; it has been hastily concluded that the olive can exist only in the vicinity of the sea; it is found in the centre of Spain, and in Mesopotamia, at the distance of a hundred leagues from the shore. The trial should be made in every place where its failure is not certain, and for this purpose, young grafted trees should be obtained from Europe, and the formation of nurseries from the seed immediately begun.

The olive is perhaps the most valuable, but it is not the only accession that might be made to our vegetable reign, if a more enterprising spirit prevailed in our husbandry, and if establishments were formed for the reception of exotic plants. This im-

portant subject claims the attention of government. Amidst its labors for the promotion of commerce and manufactures, why should not its fostering care be extended to agriculture?

The people of the United States, instructed by experience, have consecrated an altar of oblivion to the genius of the waves, and to the genius of the soil. They will not allow one system of industry to be promoted at the experience of another. We have solved transcendant problems of reconciling the interest of the individual with that of the public, by throwing down the barriers to *every* species of industry, and by leaving every man to enjoy the fruits of his labor, undiminished by the exactions of a rapacious government. Let these principles be the immovable basis of our political economy. The height of prosperity at which we have arrived, is doubtless attributable to the successive enterprizes of our merchants, and our commerce should still be cherished and defended like the sacred soil of the republic. But has not the moment arrived when we may begin to measure the greatness of our country by some other standard than simply that of commercial prosperity? With means so ample and unembarrassed, might we not give more activity and extension to works of domestic improvement? Education remains to be perfected—a national character to be formed—our strength to be established on durable foundations, by the developement of our internal resources. Institutions should be devised, which, by assimilating the feelings of our citizens, may corroborate that union which is the bulwark of our national independence, without intrenching on those subordinate sovereignties which are the guarantees of our political liberty. A taste for pacific glory should be inspired, and an impulse given to public spirit, in harmony with that magnanimous moderation which becomes the future arbiter of nations.

From these great objects no schemes of vulgar ambition should for a moment divert our ardor. Already the influence of our character far exceeds that of our strength, and our claims to the rank of a primary power are admitted by anticipation. The attention of the world is daily becoming more intently fixed upon our actions. Old Europe contemplates with reverent affection, as the hoary-headed warrior gazes on the blooming hero whose youthful achievements eclipse the glory of his sire. A great example is wanted by mankind; from us they demand it; and the cause of universal liberty is interested in our conduct.

We do not utter these sentiments in the language of reproach. Much has already been done by our counry, which is admired by contemporary sages, and which will go down with honor to a more enlightened and philosophical posterity; all that is great and

good may be hoped from her maturer wisdom. Our fathers have left us a noble inheritance, and it is our duty to improve it. What surer basis can we choose for national wealth, than a learned and enterprising agriculture? How can we more effectually strengthen the ties of interest that bind the extremities of our country in indissoluble union, than by augmenting the number and the value of their useful productions? How can the intelligence of a people be more favorably developed, than by an art which gives so wide a scope to comparative sagacity, and which brings its conclusions to the tests of immediate experience? Who are more likely to be devoted to their country, than those who have attached the hopes of their children to its soil?—There is, besides, in the profession of agriculture, something so congenial to republican manners, that we should naturally expect to see the freest country the best cultivated. Remote from the contest of sordid passions, and surrounded by all that is necessary to his happiness, the husbandman has no inducement to calculate the interest upon political corruption. An active life, spent in the open air, in the majestic presence of Nature, lends a corresponding simplicity and elevation to his character. In public stations a patriot is often driven from his purpose, by the jealous opposition of his rivals, or by the invincible prejudices of his age; he must at least, sacrifice his freedom to the duties of his office; but in a life devoted to agricultural improvement, the purest sources of rational enjoyment are united; the first want of a generous spirit, is that of being useful to mankind; the second, is that of *liberty*.

PLATE V.

A branch and fruit of the natural size. Fig. 1. Flowers of the natural size. Fig. 2. A flower magnified. Fig. 3. A drupe with the stone exposed.

CONCHOLOGY.

NO. III.

Of the Formation of Shells. The shell or covering of testaceous animals, has been considered in some measure as analagous to the bones of other animals, although its formation and growth are very different; since it serves as a base or support to the muscles, which are attached to its internal surfaces. The

principal use of the shell, however, is to serve as a covering or defence of the animal.

Testaceous animals are not only extremely different in external form, but also in the mode of their production. Some are viviparous, as most of those which inhabit bivalve shells, multivalves, and even some of the univalves; while the others, which form the far greater proportion, are oviparous. In one point, however, they all agree, that whatever be the mode of production, whether from an egg, or directly from the uterus of the mother, the shell is formed on the body of the young animal, and is proportioned to its bulk.

The best observations which have yet been made, and the most elaborate investigation which has hitherto appeared, concerning the formation and developement of shells, are those of the celebrated Reaumur, which were published in the memoirs of the Academy of Sciences for the year 1709. The same subject has been prosecuted by other authors, but their results have been nearly the same as those of this distinguished naturalist. Klein is almost the only author who has advanced a different opinion.

In his dissertation concerning the formation of shells, he charges Reaumur with supporting the opinion, that testaceous animals, when they proceed from eggs, are not furnished with the shell, but that it is formed after being hatched. This opinion, indeed, has been ascribed to Reaumur by the historian of the academy, who, in the analysis of his excellent memoir of the formation of shells, has observed, ‘that hitherto the curious have been struck with the prodigious variety, the exact regularity of structure, the singular beauty and splendor of color of shells; but naturalists have been less attentive in studying and investigating the mode of their formation. They seem to have thought that although shells, as well as the covering of crustaceous animals, are bones placed externally to the animals which they cover, it was necessary to consider them as parts of their bodies, and to include this inexplicable circumstance under that of the general formation of animals, which is incomprehensible to the human mind. They have therefore supposed that the animal and its shell proceeded from the same egg, and were developed together; and they have rested satisfied in admiring the economy of nature in providing so elaborate a covering for so low an order of animals. But this supposition, although probable, is not founded on truth. The animal only, not the shell, is produced from the egg. The discovery of this fact is owing to Reaumur.’

It must seem very extraordinary, that such an error should have crept into the abstract of the memoir of this celebrated philoso-

pher, who in the course of it has clearly expressed a contrary opinion. 'I have frequently,' says Reaumur, 'compared the shells of snails which are just hatched, and even with those which I had taken from the eggs before they were hatched, with other shells of full grown snails of the same species, with which I had left only the same number of whorls of the spire with the same shells, and then they appeared in all respects the same.' He farther observes, 'that what has been said with regard to the increase of shells, renders it unnecessary to enter into the detail of their original formation; for it is easy to conceive, that when the body of a small embryo which is one day to fill a large shell, has arrived at a certain state, in which the different teguments in which it is included, have sufficient consistence to secrete from their pores the peculiar fluid which is destined to the formation of the shell, this fluid may be deposited on the surface, may thicken, and at last become firm and solid.' And thus commences the formation of the shell, in the same way as its increase is continued. Snails do not proceed from the egg, without being previously furnished with this shell, which then has one turn and little more of the spire.

When the eggs of testaceous animals are hatched, the young appears with its shell already formed, and according to the observations of Reaumur, it has then one complete turn of the spire and a little more; but at that period the shell is extremely thin. It seems probable that the formation of the shell is posterior to that of the principal organs of the animal, as the bones in the fœtus of other animals are formed after the brain and the heart.

Reaumur has suspected that the shell is the last formed, and if proofs are wanting to establish this fact, it is certain that at particular periods, if the eggs of testaceous animals are opened, the external parts of the embryo are found already developed, without any appearance of the shell. But whatever may be the period of the formation of the shell, it may be received as an established fact, that the animal is furnished with it at the time it leaves the egg. Leuwenhoek first observed this fact with regard to oysters; the same observation was afterwards made by Lister, and extended to others, both land and river shells. This observation has been confirmed by other naturalists, and particularly by Rumphius, Swammerdam, Reaumur and Adanson. From the investigations of the latter, it appears, that although there are many of the marine testaceous animals which are viviparous, they resemble those which are oviparous, in being furnished with the shell when they separated from the parent.

Since then it appears, that the shell of testaceous animals is

completely formed previously to the developement of the animal; and that it may be considered as an essential part of its organization, let us now inquire into the mode by which its growth is effected. According to the decisive experiments of Reaumur, the enlargements of shells is owing to a juxta-position, or successive additions of earthy and animal matter, independent of any organized structure. Klein has supported a contrary opinion, and supposes that the growth of shells is effected by intur-susception or a kind of circulation. The opinion of Reaumur, however, has most generally prevailed. Excepting Bonnet, few naturalists have adopted that of Klein; and it will appear that this celebrated naturalist was led to entertain concerning the mode of the formation of shells, by the experiments of Herissant on the generation of bone and shell. From these experiments it was clearly demonstrated, that shells are composed of two substances, the one a membranaceous or animal substance, and the other an earthy matter; but no such conclusion can be drawn from them in support of the opinion, that the shell is a continuation of the body of the animal; or that it is as closely connected as the bones in the bodies of other animals; or even that this connection is formed by means of fibres of the ligament which attaches the animal to its shell; for it has been shown, that these muscular or ligamentous fibres, in all descriptions of testaceous animals, are successively separated, in proportion to the increase or enlargement of the shell. This could not possibly take place, if the evolution and formation of the shell, according to the opinion of Herissant, depended on an internal circulation, analagous to what happens in the body of the animal. In this case, the vessels which proceed from its body, having no longer a communication with those which are supposed to exist in the shell, it would be deprived of nourishment, and consequently could not increase in size. And it is found, that this separation takes place in all shells. It is gradually completed as the growth of the shell advances.

A body may increase in volume in two different ways. Either the particles of which it is composed pass through that body by means of circulation, and undergo certain changes by which they are prepared to form part of the body, or the particles of which a body is composed, may unite with it by juxta-position, without any previous circulation or preparation within the body, to the increase of which they are destined. It is in the first way, that the growth of vegetables and animals is accomplished; the second is the mode by which shells receive new additions of matter, and enlarge in size. The first is the mode of increase peculiar to living, organized substances; by the second, inorganized substances

receive new additions of matter, and increase in volume, These indeed afford sufficient characteristic marks for a natural division of bodies into two classes, namely, organized, and inorganized substances.

The experiments of Reaumur have decisively proved, that the growth of shells is owing to the latter mode of increase. These experiments were made not only on sea shells, but also on land and river shells; on univalves and bivalves; and, in all, the result was invariably the same. In conducting these experiments, he inclosed the shells, on the progress of which he made his observations, in boxes pierced with small holes so as to admit the water, but so small as to prevent the egress of the animal. These boxes were sunk in the sea, or the river, and in this way he was enabled to watch the process of the growth of the shell. He first observed, that when the animal, which exactly fitted its shell, began to increase its size, the shell in a short time, not being sufficiently large to cover its whole body, part of it was naked or unprotected. This part of the animal must always be towards the opening of the shell, because the shell being previously completely filled, it cannot extend in any other direction. All animals which inhabit shells of a spiral form, such as the snail and volute, can only extend at the head, or the opening of the shell; whereas the animals in bivalve shells, such as the muscle and the oyster, may enlarge in their whole circumference. In all the species of testaceous animals, it is this part which appears by the increase of the animal when it enlarges the shell. This increase takes place, according to Reaumur, by the following mechanism.

It is a necessary effect of the laws of motion, when liquids run in canals, that the small particles of these fluids, or the small foreign bodies mixed with them, which on account of their figure, or their less degree of solidity in proportion to their surface, move slower than the others, fly off from the centre of motion, and approach towards the sides of these canals. It even frequently happens, that these small particles attach themselves to the internal surface of these canals or tubes, and form concretions of different degrees of thickness. It is besides certain, that the fluids which circulate in these tubes, press against their sides on every point of their interior surface; so that if they were pierced with a number of small holes of sufficient diameter to give passage to the small particles of matter floating in these fluids, these particles would be deposited on the external surface where a crust would be formed similar to that of the inside; with this difference, that it would become thicker and more solid, being less exposed to the friction of the fluid, than that which is deposited in the interior of the tube.

To a similar mechanism Reaumur ascribes the increase of shells. The external surface of that part of the body of the animal which has extended beyond the limits of the old shell, is furnished with a great number of canals, in which circulate the necessary fluids for the nutrition of the animal. A great many small particles of a viscid and earthy matter are mixed with these fluids. Now, as these particles are less fluid than those of which the liquids themselves are composed, they approach the sides of the vessels, which are themselves furnished on that side of the external surface of the body of the animal, with a great number of pores, which allow them to escape from the vessels, so that they are deposited on the external surface of these tubes, or rather in that body of the animal itself, which is uncovered by the shell.

These particles of earthy and viscid matter having reached the surface of the body of the animal, readily unite with each other, and with the extremity of the old shell, especially when the excess of moisture is dissipated; and thus by their union they compose a small solid body, which is the first layer of the new addition. Other particles of similar matter continuing to escape in the same way from the excretory vessels of the animal, form a second layer from the first; afterwards a third, and a fourth, or more till the new part of the shell has acquired sufficient consistence and thickness. It is however observed to continue thinner for a certain time than a former opening, till the increase of the animal requires another enlargement of its covering.

When a testaceous animal is going to enlarge its shell, as for instance the common snail, the body projects from the opening. It is then seen to attach itself to a wall or some other solid substance, and the portion of its body which is unprotected by the shell, is soon covered with the fluids which are excreted from its surface. The pellicle which they produce when the fluid dries, is at first an elastic, but gradually assumes more consistence, and becomes at last similar to the old part of the shell. If in this stage of the process a bit of the shell is broken and removed, without injuring the body of the snail, the skin of the animal is soon covered with a fluid, which gradually thickens, and becomes solid. Twenty-four hours after the operation, a fine crust may be observed, which constitutes the first and external layer, for repairing the breach which was made. At the end of some days this layer has become thicker, and in ten or twelve days, the new piece of shell which is formed, has acquired the same thickness as that which was removed. In making this experiment, certain precautions are necessary, otherwise there is some risk of its failure. If, after the broken piece of the shell has been removed,

and particularly if the fracture is made near the edge of the opening, the animal is not supplied with a sufficient quantity of nourishment, its volume or bulk is soon diminished; and now finding that what remains of the shell is a complete covering to its diminished body, no excretion takes place for the production of a new portion. In removing snails from a wall to which they had attached themselves, for the purpose of observing the progress of the formation of the shell, some days will elapse after they are placed in the box, before the process commences, because the testaceous matter which had been already expended after fixing on the wall, must be fully supplied before any new portion can be again formed.

This experiment shows clearly, that shells are only enlarged by receiving new additions of matter, after it has been excreted from the body of the animal, and not by *intus-susception*, or a circulation through the body of the shell itself. If this were the case, the production of new matter to fill up the breach made in the shell, would first appear all round the edge of the opening, and forming a kind of callus, similar to what happens in the reproduction of bony matter in other animals,it would gradually extend till the whole breach is filled up. But, on the contrary, this matter first appears on the body of the animal from which it has exuded, and the whole extent of the opening is closed at once by the fluid which has been directly secreted from the surface of the body. Nor can it be supposed that the liquid has insensibly exuded from the shell, and falling on the body of the animal, is there collected in sufficient quantity for the formation of the new piece of shell. This is fully demonstrated by the two following experiments of the same naturalist.

Reaumur broke several shells of snails, and, having made a very large hole about the middle of the shell, and about midway between its summit and opening, he introduced between the body of the animal and its shell, through the hole, a piece of skin which was extremely fine, but of a very close texture. He glued this skin to the internal surface of the shell, so that it shut up accurately the artificial opening which he had made. It must then be obvious, that if the reproduction of the piece of shell which was removed, depended on the excretion of a fluid from the shell itself, and not on that which proceeds from the surface of the animal's body, the new piece of shell would be formed on the external surface of the piece of skin which was introduced; and it is not possible that it could be formed between the skin and the body of the animal. But the contrary of this has always happened. The new testaceous matter is always deposited on the internal surface of the skin; that is,

on the side which is in contact with the animal's body; and no matter whatever was deposited on the other surface. This experiment has been repeated by others, and has been invariably attended with the same result.

The second experiment made by Reaumur is not less decisive than the first. He took a number of snails, and broke the shells, so that he diminished the number of the turns of the spire about one seventh part. Having in this way rendered the shell too small to cover the body entirely, they were nearly in the same situation as when an increase of the animal's body requires an augmentation of the shell. He then took a bit of skin, as in the former experiment, sufficiently large to cover the opening of the shell, and introduced one of its edges between the body of the animal and the shell, to the interior surface of which he glued it; after which having folded back the other extremity of the skin on the external surface of the shell, he glued it in like manner, so that the whole external opening was completely covered with the skin. The results were exactly the same as before. The shell grew, the skin remained in its place, and that part of it which was attached to the interior surface, was fixed between the new piece and the old shell, which consequently could not contribute to its formation.

From these experiments, which may be easily repeated, it appears that the increase of shells is owing to the secretion of an earthy and viscid animal matter which is prepared in the body of the animal, and which is successively formed by layers from the interior part of the shell to the external surface. This formation is determined by the previous enlargement of the animal. The different strata or layers of which shells are composed, can be easily demonstrated by exposing them to the action of fire, and removing them before their structure is entirely destroyed. By this process the animal matter is consumed, and the earthy substance remains, exhibiting a laminated structure. The same structure may be demonstrated, as has been already observed, in detailing Mr. Hatchett's experiments, by immersing a shell of the description of mother of pearl in a diluted acid. The earthy matter in this case is dissolved by the acid, and the layers of animal matter which are interposed, resisting the action of the acid, remain unchanged, and still retain the original figure of the shell.

It is a necessary consequence of the mode in which the shells of snails are increased, that they cannot enlarge in volume, but by the augmentation of the turns of the spire, and that the length of each turn of the shell already formed, remains always the same. This may be easily put to the test of experiment, by reducing the shell of a snail which has reached its full size, to the same num-

ber of turns with those of younger shells of the same species. The two shells do not then exhibit any other difference than in their thickness; and it would be the same, by comparing the youngest shells, those which have just separated from the egg, with the first turns of those of the same species which have been reduced by breaking them to an equal diameter. The number of turns or whorls of which the spire of a shell is composed, increases very considerably the size of the shell in univalves, and one turn more or less makes a great difference in their volume. According to Reaumur, the diameter of each turn of the spire is in the snail nearly double that of the preceding one, and one half of that which follows; but in many other shells, both marine and river, the last whorls of the spire, compared with the preceding ones greatly exceed this proportion. In some, the external opening is twelve times greater than the preceding one, and in others, it is not more than eight times. This depends entirely on the increase of the animal's body, and the proportion of that increase. The growth of some is lengthwise, and in them the increase of diameter is proportionably less; while others increase more in thickness than in length. Those testaceous animals which have only a few turns in the spire of the shell, are of this description. To the former, belong such as have a greater number of turns in the spire.

Those who have adopted the opinion of Klein with regard to the formation of shells, have denied the separation of the animal from the shell, which successively takes place near the tip in univalves. It is indeed on this circumstance of the connection of the animal with the shell, that the truth of this theory depends. According to it, the animal is attached to the internal surface of the tip of the shell in univalves, and on this connection depend the increase of the shell, and even the life of the animal. But it is a certain fact, that the posterior part of the body of the animal is entirely detached from the tip of the shell; and this holds, not only with regard to all land and sea shells which have lost the first turns of the spire, and consequently those of the tip; but also in a great number of other marine testaceous animals. It seems not only certain, but even necessary, that this separation between the animal and the shell should also take place in bivalve shells, if we take a distinct and rational view of their growth. Whether this separation is suddenly effected, or by a gradual process, which is most probable, it seems to be sufficiently obvious, by examining the internal surface of the valves. This is still more strongly confirmed by sawing univalve shells, particularly those which are considerably elongated, and have a great number of turns in the

spire, in a direction perpendicular to their axes. In old shells, several of the first turns of the spire will be found completely filled up with testaceous matter, so that the tip of the shell has become quite solid, or at least it will appear to have been long unoccupied by any part of the body of the animal. But in transparent shells, as in some species of helix, it is seen that this attachment does not exist; and the *H. planorbis* can be preserved alive, although the tip of the spire is broken off.

RED OR SLIPPERY ELM.

Ulmus rubra.

Fig. 1. A leaf. Fig. 2. The seed.

Except the maritime districts of the Carolinas and Georgia, this species of elm is found in all parts of the United States and of Canada. It bears the names of *Red Elm*, *Slippery Elm* and *Moose Elm*, of which the first two are the most common. The French of Canada and Upper Louisiana, call it *Orme gras*. This tree is less multiplied than the white elm, and the two species are rarely found together, as the red elm requires a substantial soil, free from moisture, and even delights in elevated and open situations, such as the steep banks of the Hudson, and the Susquehannah. In Ohio, Kentucky and Tennessee it is more multiplied than east of the mountains, and grows on the richest lands of an uneaven surface.

This tree is 50 or 60 feet high, and one or two feet in diameter. In the winter it is distinguished from the white elm, by its buds, which are larger and rounder, and which a fortnight before their developement, are covered with a russet down. The leaves are oval-acuminate, doubly denticulated and larger, thicker and

rougher than those of the white elm, and emit an agreeable odor. It blooms in the month of April. The flowers are aggregated at the extremity of the young shoots. The scales which surround the bunches of flowers, are downy like the buds. The flowers and seeds differ from those of the wahoo; the calyx is downy and sessile, and the stamens are short, and of a pale-rose color; the seeds are larger, destitute of fringe, round, and very similar to those of the European elms; they are ripe about the last of May.

The bark upon the trunk is brown; the heart is coarse-grained and less compact than that of the white elm, and of a dull-red tinge. The wood, even in branches of one or two inches in diameter, consists principally of alburnum or sap. This species is stronger, more durable, when exposed to the weather, and of a better quality than the white elm; hence in the Western States it is employed with greater advantage in the construction of houses, and sometimes of vessels on the banks of the Ohio. It is said to be the best wood in the United States for blocks, and its scarceness in the Atlantic States is the only cause of its limited consumption in the ports. It makes excellent rails, which are of long duration, and are formed with little labor, as the trunk divides itself easily and regularly: this is probably the reason that it is never employed for the naves of wheels. This tree bears a strong resemblance to a species or a variety in Europe, known by the name of *Dutch Elm;* the bark of which is very mucilaginous and also contains sugar, a little gallic acid and super-tartrate of potass. Medicinally it is said to be alternative, tonic and diuretic, and to be useful for herpetic and leprous eruptions. If it ever do good in such cases, it must be from its mucilage sheathing the acid or acrid substances of the *primæ vitæ*, from which they arise. The leaves and the bark of the branches, macerated in water, yield a thick and abundant mucilage, which is used for a refreshing drink in colds. The bark, when reduced to flour, is said to make excellent puddings. *Sylva Americana.*

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. V.

Mode of rearing Silk Worms in Europe. 'The various operations of an establishment for the production of silk are, ordinarily, all begun and concluded in the course of a few weeks; yet

they call for a considerable degree of attention on the part of its conductor, and can hardly be brought to a successful issue without the aid of experience. This is especially the case in Europe, where atmospheric changes are continually arising, which in various ways influence the tender silk-producing insect. One false step in management might be fatal, and one day's relaxation of the breeder's cares would suffice to bring all his previous labors to nothing.

'The degree of skilfulness and care thus required for the successful rearing of silkworms upon any useful scale, cannot be adequately estimated by the experience of those persons in England, who, as a matter of curiosity or of amusement, have watched over a few hundred worms, and have wound off the silk which these have furnished, unassailed by accident or misfortune. It is very natural to suppose, that what is so easily practicable with a small number, offers little difficulty as an extensive employment. If, however, the English breeder considers the time, however short it may have appeared, and the labor, however unimportant in his estimation, bestowed on his inconsiderable brood, and thence calculates the greater labor which must attend upon the rearing of hundreds of thousands, or, perhaps, millions of insects, its insignificance will disappear. He may then naturally imagine, how great is the importance of abridging that labor, of economizing expense, and of providing in every way against accidents, which, if occurring to interrupt his amusement, would be merely vexatious, but upon the avoiding of which, under other circumstances, depend the subsistence and well being of thousands.

'The proper choice of eggs is the first care of the cultivator. From this he may relieve himself in succeeding seasons, the operations of his own filature producing the requisite quantity. The Italian writers on the culture of silk give very copious directions for choosing eggs, and for detecting and avoiding the fraudulent arts sometimes practised by their venders.

'Good sound eggs are of a bluish-gray color; those which are yellow should on no account be purchased. It is common with the peasants whose eggs are of the latter description to give them so much the appearance of sound eggs, by washing them in muddy, dark-colored wine, that considerable judgment is required to detect the cheat.

'Where silkworms' eggs are brought from a distant country, much attention is demanded to prevent their premature hatching. This has been successfully accomplished by placing them, when newly laid, and carefully dried, in glass phials closely sealed to exclude air and moisture: the whole being then immersed in earthen

pots filled with cold water, which must be renewed as often as it becomes warm.

'The hatching process, until within a very few years of the present time, was usually conducted in a very immethodical or uncertain manner. Many cultivators depended on the spontaneous appearance of the worms, called forth only by the natural warmth of the advancing season.* Others had recourse to the heat of manure beds, but the method most frequently employed was to foster them into life by the heat of the human body. The mode of accomplishing this, was to place a small silk or cotton bag containing one or two ounces of eggs in the bosom next to the skin. The persons with whom these deposits were intrusted were forbidden to use any violent exercise, lest their charge might be crushed, or otherwise sustain injury through the consequent inequality of temperature. It would have been unsafe to continue the bags in this position during the night, and it was therefore most usual to place them beneath the pillow, which was previously heated to the temperature of the human body, using precautions also against injury, by placing some stiff substance over the eggs. When this companionship had lasted three days, and it was judged that the worms were shortly about to appear, the eggs were very gently transferred to shallow boxes made of thin wood, similar to those used for containing wafers: these were placed between warmed pillows as before described; and if the hatching were still further delayed, freshly-heated pillows were supplied through the ensuing day, and continued until the insects had burst their shells. Some persons used warmed pillows from the commencement, and avoided the system of human incubation.

'Count Dandolo recommended and adopted the use of stoves for heating the apartment in which his worms' eggs were hatched, and by such means rendered the operation in a great degree certain, removing, at the same time, much of the trouble by which it had previously been accompanied. Previously to placing the eggs in this heated atmosphere, the count caused the cloths to which the eggs adhered to be agitated for five or six minutes in a vessel containing water, in order to lessen the adhesiveness of the matter which retained them on the cloths. Having then suffered the water to drain from them during two or three minutes, the cloths were stretched out on tables, and the eggs were gently scraped from them by an instrument whose edge was not sufficiently sharp to cut the eggs, nor yet so blunt as to crush them. The eggs, thus removed, were placed in water and washed, still

* This is considered the most judicious way in the United States.

further to free them from gum, and to promote their separation from each other. If any floated on the surface in this washing, they were removed and destroyed as spoilt. The water again being drained from them, the eggs were next washed in some sound light wine, and gentle friction was used to perfect their mutual separation. They were then strained and dried, by being placed on an absorbing substance in a dry airy place, whose temperature was between forty-six and fifty-nine degrees of Fahrenheit's scale, there to await the proper moment for placing them in the stove room. It has always been customary in Italy to employ wine as a solvent for the gum which causes the eggs to adhere together, and which is thought to make the task of disengaging itself from the shell more difficult to the insect.

'It has been suggested, that one hatching room, upon a sufficient scale, might be employed for the general accommodation, in bringing forth all the silkworms of the surrounding district; and if proper confidence could be placed in the proprietor of such an establishment, there is no doubt of its great convenience to the cultivators.

'When eggs are first placed in the stove room, its temperature should be sixty-four degrees; on the third day this should be raised to sixty-six degrees; and on each following day the heat should be increased one or two degrees, so that on the tenth day it shall have reached eighty-two degrees, which point must not be exceeded. The degree of warmth required for hatching the eggs of silkworms depends very much, however, upon the temperature to which they have been exposed during the preceding winter. It is, therefore, important that this point should be considered, so as to avoid premature hatching on the one hand, and too great a retardation on the other, which would follow if the eggs had been exposed to any severity of cold.

'When the eggs assume a whitish color, it is a sign that they are about to be hatched; and now, by the aid of a magnifying glass, the worms may be seen formed within the shells. Sheets of white paper, abundantly pierced with holes, or otherwise pieces of clear muslin, should now be placed over the eggs, covering them entirely; when, as the worms come forth, they will climb through to the upper surface of the paper or muslin.

'To collect the worms for the purpose of conveying them to the rearing house, small twigs of mulberry, with very few leaves, are placed on the paper. On these leaves the newly-hatched worms immediately fix, and fresh twigs being constantly supplied to meet the wants of the continually-increasing number of worms, the whole may be readily collected. When their removal to any considerable

distance is necessary, this is easily and safely performed by placing the sheets of paper and mulberry twigs in boxes or well-lined baskets, using every precaution to exclude the external air from the now-delicate brood. The worms should be removed only in fine weather, and during the warmest part of the day, and they should be supplied with leaves for their consumption while on the road.

'The apartment wherein the newly-hatched worm sare placed must be dry and warm, with its windows opening on opposite sides, that perfect ventilation may be obtained when desirable. The room should be furnished with a stove, and thermometers must be provided, that the temperature may be precisely regulated. Wicker shelves are usually placed around at convenient distances, and are lined with paper; on these the worms are placed. The greatest precautions must be taken to prevent the intrusion of rats and mice, as well as many of the insect tribe, as these are more or less destructive to silkworms. Smoke, and bad smells, are likewise considered prejudicial, and must be avoided.

'All writers on the treatment of these insects agree in recommending, that worms which are not hatched at the same time should on no account be placed together. The neglect of this precaution would occasion constant trouble to the attendants; the changes occurring at different periods, it would be impossible to attend to the quantity of their food with the degree of regularity that is desirable. This point is so much insisted upon by many cultivators, that to avoid the evil, all eggs which remain unhatched beyond the second day after the first appearance of the worms are destroyed. It is said also, that if those of a later birth are reared, they generally prove weak in constitution, and produce less than their proper quantity of silk.

'It has been computed, that three square feet of surface afford ample space for the worms proceeding from an ounce of eggs, until the period of their first sickness is passed; and that this space should be multiplied thrice at each succeeding age. Count Dandolo considered that silkworms would be injuriously crowded in these dimensions, and recommended, that eight square feet should be allotted to the worms during their first age; fifteen feet for the second age; thirty-five feet for the third; eighty-two and a half feet for the fourth; and about two hundred feet for the fifth age.

'The mulberry leaves given to the newly-hatched brood should be young and tender, and chopped into minute portions. These should be strewed evenly over the whole space of the shelves, that there may not be any unnecessary crowding of the insects in one spot. It is indeed advisable, when—as they sometimes will

—the worms get heaped upon one another, that a leaf should be presented over them; to this some will quickly attach themselves, and may then be removed to a less crowded situation.

'The worms proceeding from one ounce of eggs will consume six pounds of chopped leaves before their first moulting. Their second age is of shorter duration, but the greater size of the worms requires a more abundant supply of food; and eighteen pounds of leaves, chopped less finely than before, must be given, during its continuance, to the same number. In the third age, sixty pounds of leaves, still a little chopped, must be given; one hundred and eighty pounds will be consumed during their fourth age; and in their fifth and longest age, one thousand and ninety-eight pounds of leaves are devoured by these insects, which, when hatched a few weeks before, weighed less than an ounce.

'These quantities are stated on the supposition that the worms are uniformly healthy. If many of them should die in the intermediate time, the weights mentioned will be in excess. On the other hand, if the season should be wet, the leaves will not contain the usual nourishment, with reference to their weight, and more must be given; whereas, if the season should prove more dry than ordinary, the nutriment in the leaves will be greater, and the quantity given may be diminished with advantage. The skill of the cultivator is shown by the weight of silk obtained in proportion to the leaves consumed; and his judgment is tasked to apportion these according to their nutritive properties. There will be no real economy in keeping the consumption of food too low; this, however, is not a common fault, and evils occur much more frequently from over feeding and waste of leaves.

'The worms should be fed with regularity four times a day; and intermediate repasts may be occasionally given, where their appetites appear to be increased in voraciousness. The advantage of chopping the leaves for young worms consists in the economy it introduces. Many thousand insects may, by this means, feed simultaneously upon a few ounces of leaves, whose freshly-cut edges seem better adapted to their powers when newly hatched. If the leaves were given to them whole, a much greater number must be supplied than would be consumed while their freshness lasted, and great waste would be the consequence. The worms will always quit stale leaves for those which are newly gathered. Availing themselves of this fact, some persons provide wire-bottomed frames, which they cover with fresh leaves, and lower them within reach of the worms. These instantly make their way through the reticulations of the wire, and fixing upon the leaves above, the frame may be raised and the litter removed with-

out touching the worms, which might be injured by even the gentlest handling.

'When the silkworms give indications that they are about to spin, little bushes must be provided for the purpose. These may be of broom, heath, clean bean stalks, or, in short, any bush or brushwood that is tender and flexible. These should be arranged upright in rows between the shelves, with intervals of fifteen inches between the rows. The bushes should be so high as to be bent by the shelf immediately above into the form of an arch. They should be so spread out, that a supply of air should freely reach every part, and ample space should be afforded for the worms to fix themselves and spin; otherwise, there is great hazard of their forming double cocoons, in which two worms assist in the preparation of one dwelling for both; the silk in these is so much less adapted to the purposes of the reeler, that a double cocoon is worth only one half the price of a single one. Inattention to this point is very common, and occasions constant losses. When the twigs already erected appear to be adequately furnished with worms, other similar hedges should be formed, parallel to the first. The spaces between the shelves will thus present the appearance of small avenues or arbors covered in at the top.

'The worms at this time require much careful watching, and occasional assistance must be afforded to those which are sluggish, that they may find an elligible spot for forming their cocoons. Those worms which appear still inclined to feed must be supplied with leaves; so long as the slightest inclination for food remains they will not attempt to form their cocoons. It will sometimes happen, that even after they have climbed among the branches for the purpose of spinning, they will again descend to satisfy their last desire for food. "I have seen them," says a minute observer, "stop when descending, and remain with the head downwards, the wish to eat having ceased before they reached the bottom." In such a case, they should be turned with their heads upwards, as the contrary position is injurious to them. If, at this time, many appear weak and inert, remaining motionless on the leaves, neither eating nor giving any sign of rising to spin, some means must be taken to stimulate them to the exertion. It was the ancient practice, and found to be efficacious for this purpose, to convey some pungent article, such as fried onions, into the apartment, the effluvia from which revived the worms, inciting some to take their last meal, and inducing others, whose desire for food had ceased, to climb the twigs and begin their labors. The same end is now generally and unfailingly attained, by removing the sluggish worms into another apartment, the temperature of which is higher.

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All these minute directions may perhaps appear frivolous; but it is only by an unceasing attention to these and the like minutiæ, that any tolerable success can be secured. When all the previous cares and labors of an establishment have been satisfactorily accomplished, if the hedges be not well formed, are irregular; or too thick in any parts, so as either to impede the circulation cf air, or too far to limit the space in proportion to the number of worms, ill success will be sure to follow. Instead of the proper number of fine single cocoons, many will be double, others imperfect or soiled, and even some of the silkworms will be suffocated before the completion of their labors.

'It is essential, in every age of the worms, to attend to the regulation of temperature in their apartments; and at no time is this more necessary than while they are forming their cocoons. If, at this time, they are exposed to much cold, they desist from their labors. Should the balls be sufficiently thin, the insects may be discerned, either quite inactive, or moving very slowly. On the temperature being raised, they will immediately resume their work with renewed activity, and will once more desist, if the cold be again allowed to exert its influence. After they have remained inactive from this cause for a short time, they put off their caterpillar form, and assume that of the chrysalis, without having sufficient energy to complete their silken covering.

'The fifth volume of the transactions of the Society for the Encouragement of Arts, &c. contains a letter upon this subject from a gentleman, who relates, that in the summer of 1786 he had successfully reared to their full growth more than thirty thousand silkworms, when at the beginning of July, and just as they appeared about to spin, a chilling north-east wind set in, and many of the worms became chrysalides, without attempting to spin. On the examination of these, it appeared that the glutinous matter in their silk reservoirs had become so congealed by the cold, as to resemble strong tendons, both in appearance and tenacity; which sufficiently accounted for the inability of the insects to draw forth the silk in filaments. Thousands of the worms changed in this profitless manner daily, until at length, the survivors being removed into an apartment artificially warmed, they immediately applied themselves to the performance of their usual functions. It is desirable that while silkworms are in the act of spinning, the temperature of their apartment should be maintained as high as 70 degrees, and it is at the same time equally important that free ventilation should be secured.

'The opinion has been very generally entertained that violent noise disturbs, and injuriously affects the worms, and that any

sudden report, as of fire arms or thunder, will cause them to fall from their arbors. The peasants in Italy who attend on silkworms are so strongly of this opinion, that if the caterpillars omit to rise and spin after thunder has been heard, they consider its noise as the sole reason of the failure; they are always desirous of removing every cause for noise from about the establishment. This opinion appears, however, to be badly founded, and has been satisfactorily refuted by persons who have made experiments to ascertain the fact. Silkworms have been reared in all the bustle of a town, exposed to the barking of dogs, and to concerts of music, without in any way exhibiting signs of being affected by the noise. The following statement is conclusive. It is taken from the "Cours d'Agriculture," written by Monsieur Rozier, and recounts an experiment performed in the establishment of Monsieur Thome, a considerable silk cultivator, and one of the earliest writers on the subject. These gentlemen, Messrs. Rozier and Thome, in the presence of many witnesses, fired several pistol shots in the apartment where silkworms were either spinning, or rising preparatory to their labor; and the only worm that dropped was evidently a sickly insect, that could not have formed its cocoon under any circumstances!

'It is seldom that any opinion upon a point of practice is entertained, without some ground for its existence. The Italian peasants, although certainly wrong in attributing any evil effects to the agency of noise, might have been correct had they ascribed the evil to that great accumulation of electricity in the atmosphere which attends the discharge of the fluid, from one cloud which is overcharged upon another which is deficient; or which accompanies the fluid in its passage between the clouds and the earth, until an equilibrium establishes itself in the mass. "Before this equilibrium is gained, however," says Monsieur Rozier, "we know that many persons exhibit symptoms of strong excitement, falling into convulsions, or even being affected by fever. Is it, then, surprising, that insects charged with a matter so highly electric as silk should become oppressed or overpowered by the superaddition of that which they receive from the atmosphere?" The peasants in the silk provinces of France have long been accustomed to place pieces of iron in the neighborhood of the insects. If asked to assign their motive for this, their reply is, that their fathers and grandfathers did so before them, and that therefore the practice must be desirable. May we not imagine that this custom had its rise from the remarks of some philosophic observer of the laws of nature, and who, under other and more fa-

vorable circumstances, might have been led, by generalizing, to anticipate the discoveries of Franklin?

'Monsieur Rozier,' in the work already quoted, recommended the use of metallic conductors; and himself proved their efficacy. In connection with some shelves containtng silkworms, he placed thin iron wires, and carried them through the wall into a cistern of water. The remaining shelves were, in every other respect, similarly circumstanced to these; but he uniformly found that, when thus protected, the worms were decidedly more healthy and active than those unprovided with conductors.'

ORNITHOLOGY.

NO. V.

Nests of Birds. Most birds, at certain seasons, live together in pairs, and the union generally continues while the united efforts of both are necessary in forming temporary habitations, and in rearing their offspring. Eagles and other birds of prey continue their attachment for a much longer time, and sometimes for life. The nests of birds are constructed with so much art as to baffle the utmost exertion of human ingenuity to imitate them. The mode of building, the materials they make use of, as well as the situation they select, are as various as the different kinds of birds, and are all admirably adapted to their several wants and necessities. Birds of the same species collect the same materials, arrange them in the same manner, and make choice of similar situations, for fixing the places of their temporary abodes. Wherever they dispose themselves, they always take care to be accommodated with a shelter, and if a natural one does not offer itself, they very ingeniously make a covering of a double row of leaves, down the slope of which the rain trickles, without entering into the little opening of the nest that lies concealed below. In forming the nest, they make use of dry wood, bark, thorns, reeds, thick hay and compact moss, as a foundation, and on this, as a first layer, they spread and fold in a round form, all the most delicate materials, as down, wool, silk, spiders' webs, feathers and other light substances, adapted for the purposes for which they are intended, and to the climate in which the nest is situated. Thus, the ostrich in Senegal, where the heat is excessive, neglects her eggs during

the day, but sits on them during the night. At the cape of Good Hope, where the heat is less, the ostrich like other birds, sits upon her eggs both day and night. In countries infested with monkies, many birds, which in other climates build in bushes and clefts of trees, suspend their nests upon slender twigs, and thus elude the utmost art of their enemies. In all cases we may observe, without entering into particulars, that the architecture of the nest's of each species, seems to be adapted to the number of eggs, the temperature of the climate, or the respective dimensions of the little animal's body. Small birds, whose eggs are generally numerous, make their nests warm, that the animal heat may be equally diffused, but the larger species are less solicitous in this respect. The smaller tribes also, that live upon fruit and corn, and are often regarded as unwelcome intruders upon the labors of man, use every caution to conceal their nests from the eye, while the only solicitude of the great bird is to render their refuge inaccessible to wild beasts and vermin.

ON THE DEW.

There is not a phenomenon of nature more common, nor more beautiful than that of dew. The poets of course have seized it with avidity, to decorate their favorite themes, and particularly their descriptions and personifications of the morning. Milton introduces it into his descriptions with a peculiar felicity:

> 'Now morn her rosy steps in th' eastern clime
> Advancing, sow'd the earth with orient pearl.'

The same divine bard, in speaking of the prodigious host of satan, has introduced dew into a most beautiful simile:

> 'An host
> Innumerable as the stars of night,
> Or stars of morning, dew drops, which the sun
> Impearls on every leaf and every flower.'

In Samson Agonistes, when Delilah comes to visit her eyeless husband, she is afraid to approach; and Milton has made her silence most beautifully expressive: the chorus tells Samson:

> 'Yet on she moves, now stands, and eyes thee fix'd,
> About t' have spoke, but now, with head declined,
> Like a fair flower surcharged with dew, she weeps,
> And words address'd seem into tears dissolved,
> Wetting the borders of her silken veil.'

Thus Pope in his elegy to the memory of an unfortunate lady:

> 'Yet shall thy grave with rising flowers be drest,
> And the green turf lie lightly on thy breast;
> There shall the Morn her earliest tears bestow,
> There the first roses of the year shall blow.'

'The falling of the dew is a phrase received in all languages, among all people, learned and ignorant; and all express by it their opinion that those drops of water which we find in mornings and evenings on the grass and herbage of the fields have descended from the upper regions of the air. On the contrary, we assert, not as an opinion, but a certainty, that these drops of dew never, in this state, were higher above the earth than we see them, and that they do not descend from on high at all, but rise out of the earth, and never, as dew, fall to it again.* There is, indeed, no law in nature by which dew could be formed as it has been generally understood to be; but all the established doctrines of philosophy and mechanics concur in the production and formation of it upon this plan The earth is, to some considerable distance, always more or less moist; the action of the sun heats the earth's surface, and heat must raise that moisture up in vapor; the heat occasioned by the sun will continue, though in a more remiss degree, during the whole night; and while it continues, vapors will also continue to be raised. It is evident, therefore, that vapors are rising all day and all night from the earth. What rise in the day time are dispersed and evaporated by the heat of the air as soon as raised, and we see nothing of them; but what rise in the absence of the sun, and in a cooler state of the air, form themselves into drops, according to the known laws of attraction. Such, then, is the nature and origin of dew; it is water raised in form of vapor from the earth, in consequence of its being heated by the sun; it collects itself into drops on any thing proper to receive and retain it; or it hangs on the lower regions of the air, in form of a fog or mist, till the sun's rays evaporate and dissipate it. Such are my assertions in regard to dew. The facts which led to, and will be found to support them, are these. The late Lord Petre had engaged me to spend a part of the last summer of his life at his house in Essex. He was as fond as myself of experiments that tended to some obvious purpose, and accompanied my observations during that period. One of these was an experiment in regard to the quantity of dew suspended in the air

* Though the condensation of vapor into dew may take place all the way to the surface of the earth, and be greatest nearest to the surface, yet the dew does fall after it has been formed into sensible particles.

at the different periods of the night. The manner of proceeding was by hanging up several bundles of tow, at different heights in the air, and weighing them from time to time, as they became more and more wetted by it. We evidently found from this, that the dew impregnated the air in greater quantities in the beginning of the night than at any other time; the increase of moisture growing less and less towards the morning. Additionally to this, however, I discovered that those bundles of tow which had hung lowest, or nearest the earth, were wet sooner than those which were placed higher. From this circumstance I alleged that the dew did not descend from the air, but ascend from the earth. The thought at first startled his lordship; but we determined to give it a fair trial. We suspended a large square of glass flatwise, by a string, from a horizontal pole laid over the tops of two distant trees in the garden, and we found its lower surface became wet sooner than its upper. From these experiments, nothing can be more evident than that the "falling of the dew" is an improper phrase, and the generally-received opinion which gave rise to it is a false one.*'

The Holy Scriptures abound with admirable allusions to dew, and it is always represented as a great blessing. 'Blessed of the Lord,' says Moses, speaking of Joseph, 'be his land, for the precious things of heaven; *for the dew,*' &c. And the want of it is represented as a curse; 'Ye mountains of Gilboa,' said David, '*let there be no dew!*' The favor of the Divine Being is compared to the dew; 'I will be,' says the Lord, by Hosea, '*as the dew* unto Israel; he shall grow as the lily, and cast forth his roots as Lebanon.' Heavenly doctrine, or the word of God, is likewise compared to dew. 'My doctrine,' says Moses, 'shall drop as the rain, *my speech shall distil as the dew*, as the small rain upon the tender herb, and as the showers on the grass;' that is, my doctrine shall have the same effect upon your hearts, as dew has upon the earth; it shall render them soft, pliable, and fruitful.' But the admirable allusions to dew in holy writ are too numerous to be quoted. In a word, these transparent beauties of the morning not only furnish us with poetic images and philosophic knowledge, but with very powerful motives for a life of piety, benevolence and virtue. Their great utility to the vegetable kingdom, in particular, should lead us to the unceasing adoration of that gracious Being, who created nothing which has existence merely for an object of idle speculation.

* Dr. John Hill.

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR MARCH, 1832.

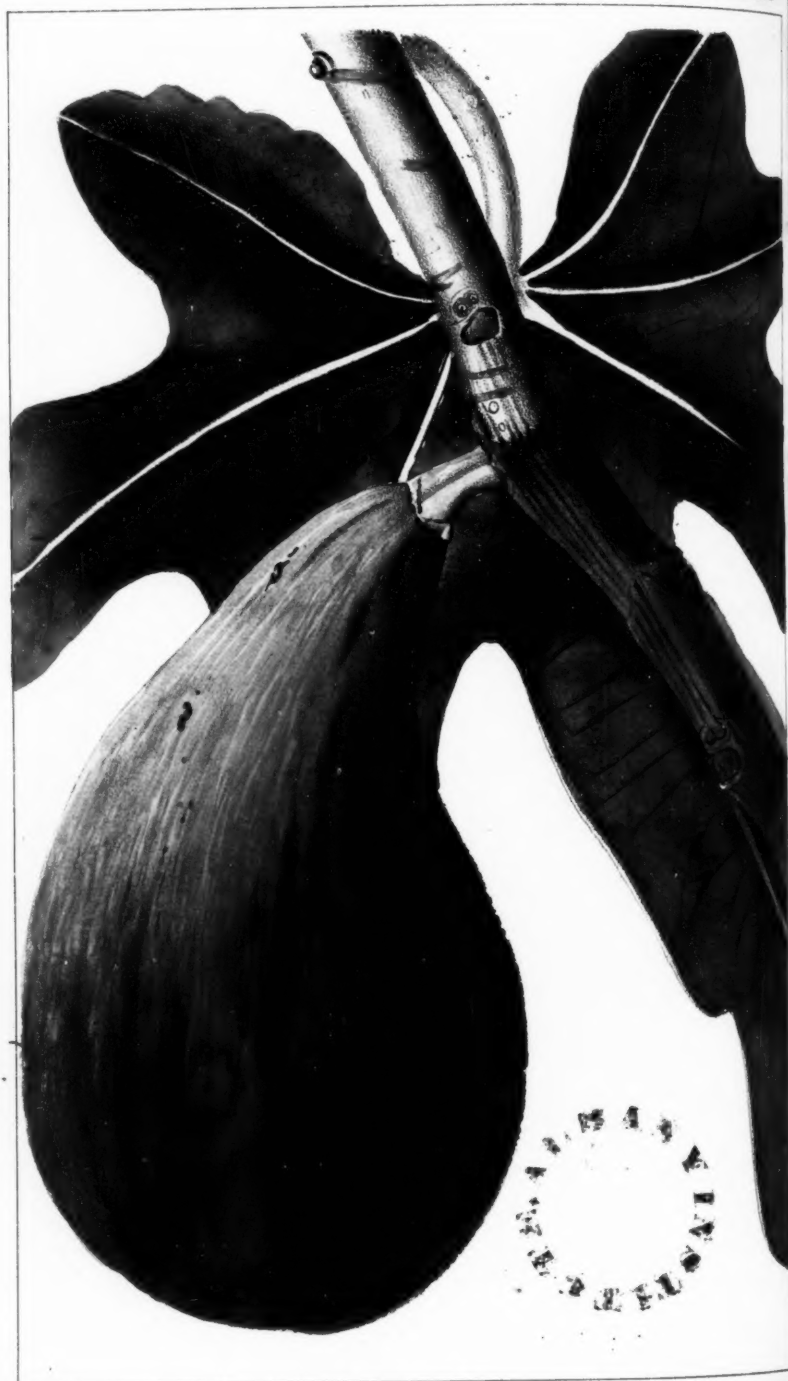
[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inch.*
1	22	30	23	30.43	30.49	30.50	Fair	Fair	Fair	N. W.	N. W.	N. W.	
2	52	53	55	30.50	30.49	30.30	Fair	Fair	Fair	N. W.	S. E.	S. W.	
3	36	46	34	30.00	29.95	30.12	Cloudy	Fair	Fair	S. W.	N. W.	N. W.	
4	27	38	33	30.20	30.20	30.20	Fair	Fair	Fair	N. W.	E.	E.	
5	33	38	39	30.08	30.00	29.98	Snow	Rain	Rain	E.	E.	E.	
6	37	37	34	29.61	29.57	29.60	Cloudy	Rain	Fair	N. E.	N. W.	N. W.	1.64
7	29	33	34	29.68	29.80	30.02	Fair	Fair	Fair	N. W.	N. W.	N. W.	
8	22	36	38	30.19	30.15	30.10	Fair	Cloudy	Fair	N. W.	N. W.	N. W.	
9	37	59	44	30.15	30.15	30.10	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	
10	46	59	42	30.12	30.20	30.40	Fair	Fair	Fair	S. W.	S. W.	N. W.	
11	38	43	39	30.40	30.39	30.28	Fair	Cloudy	Rain	E.	N. E.	N. E.	
12	50	62	48	30.00	29.90	29.60	Rain	Cloudy	Fair	S. W.	S. W.	S. W.	*
13	43	53	39	29.52	29.62	29.70	Fair	Fair	Fair	N. W.	N. W.	N. W.	
14	19	22	17	29.75	29.80	30.10	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	
15	15	32	27	30.33	30.40	30.45	Fair	Fair	Fair	N. W.	S. W.	S. W.	
16	28	43	32	30.41	30.40	30.38	Fair	Fair	Fair	S. W.	S. W.	S. W.	
17	36	38	36	30.12	29.70	29.58	Cloudy	Rain	Rain	N. E.	N. E.	N. E.	
18	20	17	19	29.51	29.62	29.94	Snow	Fair	Cloudy	N. W.	N. W.	N. W.	
19	15	22	22	30.10	30.20	30.25	Fair	Fair	Fair	N. W.	N. W.	N. W.	
20	18	36	34	30.28	30.22	29.95	Fair	Fair	Fair	N. W.	S. W.	S. W.	
21	39	43	32	29.66	29.54	29.62	Rain	Cloudy	Fair	S. W.	S. W.	N. W.	
22	24	32	24	29.77	29.85	30.02	Fair	Fair	Fair	N. W.	N. W.	N. W.	
23	22	40	34	30.10	30.19	30.15	Fair	Fair	Fair	N. W.	N. W.	S. W.	
24	38	60	48	30.05	30.05	30.02	Fair	Fair	Fair	S. W.	S. W.	S. W.	
25	43	68	58	30.02	30.02	30.00	Fair	Fair	Fair	S. W.	S. W.	S. W.	
26	52	59	32	29.94	29.90	30.00	Cloudy	Cloudy	Rain	S. W.	S. W.	N. W.	
27	26	36	30	30.02	30.35	30.37	Fair	Fair	Fair	N. W.	N. W.	N. W.	
28	26	36	32	30.37	30.37	30.30	Fair	Fair	Fair	N. W.	E.	S. W.	
29	31	35	27	30.30	30.30	30.39	Fair	Fair	Fair	N. E.	N. E.	N. E.	
30	25	40	32	30.39	30.42	30.30	Fair	Fair	Fair	N. W.	E.	S. W.	
31	34	59	44	30.16	29.95	29.72	Fair	Fair	Fair	S. W.	S. W.	S. W.	

Depth of rain fallen 1.64 inches.

***The quantity of rain fallen in the remainder of the month, was too small to be measured.**

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.



Pendleton's Lithog.y Boston

THE BRUNSWICK FIG.